OLLSCOIL NA hËIREANN GAILLIMH

NATIONAL UNIVERSITY OF IRELAND GALWAY

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SUMMER EXAMINATIONS 2008

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Bachelor of Science in Information Technology

ARTIFICIAL INTELLIGENCE (CT421) - 4IF1

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Time allowed: *three* hours.
Attempt *two* questions from section A AND *two* questions from section B.

SECTION A

1. Write the following Prolog predicates:

   (a) max(X,Y,Max). where Max is the larger of the two numbers X and Y
   (5 marks)

   (b) maxlist(List,Max). where Max is the largest element in the list List.
   (7 marks)

   (c) ordered(List). which is true if the list contains a list of numbers in ascending order.
   (13 marks)

2. Write the following Prolog predicates:

   (a) square(X,Y). where Y is the square of X, e.g.:
   :-square(5,Y).
   Y = 25
   Explain how your predicate would respond to the following query:
   :-square(A,36).
   (7 marks)

   (b) sumlist(List,Sum). where Sum is the sum of the elements in the list List. e.g.:
   :-sum([1,2,3],X).
   X = 6
   (9 marks)

   (c) Explain what is meant by the "Closed World Assumption" in Prolog, pay particular attention to its advantages and disadvantages.
   (9 marks)

3. (a) Explain what is meant by Qualitative Reasoning. What are its advantages and disadvantages.
(4 marks)

(b) Give an example of an application where Qualitative Reasoning would be suitable. Justify your answer.
(3 marks)

(c) Give an example of an application where Qualitative Reasoning would not be suitable. Justify your answer.
(3 marks)

(d) Given the following constraints (which represent the motion of a ball being thrown in the air):

$$DERIV(x, v)$$
$$DERIV(v, a)$$
$$a = g < 0$$

and the quantity spaces:

$$\{-\infty, 0, \infty\}\ for\ v$$
$$\{0, top\}\ for\ x$$

If the initial state is:

$$QS(x, t_1) =< top, std >$$
$$QS(v, t_1) =< 0, dec >$$
$$QS(a, t_1) =< g, std >$$

What are the possible next states? (Show your workings)

Rule-id	$QS(v, t_i)$	$QS(v, t_i, t_{i+1})$
P1	$< l_i, std >$	$< l_i, std >$
P2	$< l_i, std >$	$< (l_i, l_{i+1}), inc >$
P3	$< l_i, std >$	$< (l_{i-1}, l_i), dec >$
P4	$< l_i, inc >$	$< (l_i, l_{i+1}), inc >$
P5	$< (l_i, l_{i+1}), inc >$	$< (l_i, l_{i+1}), inc >$
P6	$< l_i, dec >$	$< (l_{i-1}, l_i), dec >$
P7	$< (l_i, l_{i+1}), dec >$	$< (l_i, l_{i+1}), dec >$

(10 marks)

(e) What discrete states would the ball pass through after being thrown up into the air?
(5 marks)

SECTION B

4. (a) In the context of non-player character (NPC) behaviour, explain what is meant by the term finite state machine
   (10 marks)

   (b) In the context of pathfinding in a game,differentiate briefly between informed and heuristic search
   (10 marks)

   (c) Are finite state machines and search techniques all that you need in order to develop an NPC in a computer game in your opinion?
   (5 marks)

5. (a) In the context of genetic algorithms, explain what is meant by the terms chromosome and fitness function
   (8 marks)

   (b) It is required to develop a program writing program. By considering a small stack machine and sketching a suitable fitness function, indicate how this might be achieved by genetic means
   (17 marks)

6. (a) In the context of interaction, distinguish between event driven and topic driven dialogue engines
   (9 marks)

   (b) Outline in brief how a typical Eliza-like system works
   (8 marks)

   (c) What difficulties, if any, do you see for the development of computational approaches to humour?
   (8 marks)